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INSECT BEARING AMBER IN INDONESIA AND THE PHILIPPINE ISLANDS

J. Wyatt Durham

Museum of Paleontology, University of California, Berkeley

Examination of amber collected by the author from the marine Miocene of Central Sumatra, and of amber from the Philippine Islands has shown the presence of fossil insects in both areas.

During the years 1936-1939 the author was engaged in geological exploration in West Java (Bantam) and Central Sumatra for a subsidiary of the Standard Oil Company of California. In the course of the field investigations many pieces of amber were noted as occurring erratically in the marine sediments (sands, clays, and marls) being studied. The amber was examined (by methods now known to be inadequate) for insects and other fossils at that time, but none were observed. Because of this the amber was not considered to be critical and it was not carefully collected or recorded. Some of the presumed better pieces and larger pieces were saved in the hope that it might serve for jewelry. Over the intervening years most of the amber has been lost or discarded as it was found to be too brittle for this purpose. Fortunately a few pieces from Sumatra without precise locality data are still in the University of California Museum of Paleontology collections and a recent more critical examination shows that some pieces do contain insects as well as other possible fossils.

Most of the Sumatran amber is very dark reddish brown in color, often streaked with lighter colored seemingly more "impure" material and usually highly fractured. This amber is mostly so dark that it is extremely difficult to see into the interior except in relatively thin fragments, and thus it is difficult to determine whether or not there are any insects in it although foreign inclusions can be seen in some pieces. Some pieces are much lighter brown in color and contain a large amount of seemingly "earthy" material and as a result are more or less opaque. A piece of this "earthy" amber has yielded a beetle (probably a Scolytid) upon being broken and a few other fragments of presumable insect origin have been seen in other pieces.

The Sumatran amber was collected from the Telisa, Lower

Palembang, and Middle Palembang formations of the Goenoeng Toea area of Central Sumatra. This area is on the northeast side of the Barisan mountains that form the backbone of the island, a little over 700 kilometers northwest of the town of Palembang and about 260 kilometers southeast of the town of Medan. According to the few notes now available amber was collected in about six different places along the Aek [river] Pane, Aek [river] Sihapas, and Soengi [river] Baroeman, as well as in localities along smaller streams tributary to these rivers. The Telisa, Lower Palembang, and Middle Palembang formations in which the amber was found are generally assigned a Miocene age (Leroy, 1944:12) with the Middle Palembang being the youngest and probably being close to the Miocene—Pliocene boundary.

In West Java (Bantam) the observed amber was of very similar character to that in Sumatra but was more abundant in the marine Pliocene rocks than in the Miocene. The amber was mostly found in exposures along the Tjioedjoeng river and its tributaries in an area starting about 15 kilometers southwest of the town of Rangkasbitoeng and extending about 25 kilometers south and west from that point. This town is about 80 kilometers slightly south of west of Djakarta [Batavia].

The University of California Museum of Paleontology collections also contain a few small pieces of amber from Luzon Island in the Philippines collected by R. E. Dickerson from his locality 11x (Dickerson, 1921:4, 11). The amber is of the same impure "earthy" type as the fossiiferous light brown materials from Sumatra. Opposing surfaces of a broken piece reveal the endoskeletal parts of a brachycerous dipteran, probably a muscoid. The material was collected from a fossiliferous yellow soft sandstone (Canguinsa formation) exposed on the west bank of Sapa Tubigbinukot 400 yards upstream from mouth of Sapa Yaknas, Bondoc Peninsula, Tayabas Province, Luzon. The Canguinsa formation has been referred to the upper X stage of the Tertiary of the Philippines and considered to be about upper Miocene in age by Corby *et al* (1951, pl. 49, column 49, and pl. 48). However, R. M. Kleinpell (personal communication, March 14, 1956) has indicated that additional unpublished data shows that this stage should probably be referred to the Pliocene.

In both Java and Sumatra, and by analogy possibly in Luzon

also, the amber occurs erratically in the marine sedimentary section, with no local concentrations being noted. Thus possible future collections for fossil insects would have to be made by hunting up and down the streams, examining all available rock exposures.

The material here recorded is now being studied in the Department of Entomology of the University of California (Berkeley). The insects were identified by Drs. P. F. Bonhag (Diptera) and P. D. Hurd (Coleoptera) of that department.

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FIRST REPORT OF TRICHOCORIXA CALVA (SAY) FROM CALIFORNIA

(Hemiptera: Corixidae)

ROBERT D. LEE AND RAYMOND E. RYCKMAN

School of Tropical and Preventive Medicine, Loma Linda, Calif.

Ten specimens of *Trichocorixa calva* (Say) were taken from the western side of Davis Lake, Imperial County, California, on March 29, 1955, by R. D. Lee, R. E. Ryckman, and D. Spencer. Although *T. calva* has been reported from Arizona[1] and from Baja California, Mexico[2], it has not been reported from California. The specimens were very kindly identified by Dr. R. I. Sailer and have been deposited in the California Academy of Sciences. —ROBERT D. LEE and RAYMOND E. RYCKMAN, *School of Tropical and preventive Medicine, College of Medical Evangelists, Loma Linda, California.*

[1] Sailer, R. I., 1948. The genus *Trichocorixa* (Coreidae, Hemiptera). Univ. Kansas Sci. Bull. 32:289-407.

[2] Lee, R. D., 1954. First report of *Trichocorixa calva* (Say) from Mexico. Pan-Pac. Ent. 30(4) :250.

NOTES ON TWO MILLIPEDE-FEEDING CARABIDS

J. W. MacSwain[1] and W. V. Garner[2]

During the course of a study on the larvae of North American Carabinae it was discovered that two closely related genera prey almost exclusively upon millipedes. As this is a rare feeding habit among the Insecta, the following observations are of interest.

Promecognathus laevissimus Dejean and *Metrius contractus* Eschscholtz are common members of the Carabid fauna of the San Francisco Bay Region, being especially evident during the periods of Fall and Winter rains, when they occur on or near the soil surface. Field work revealed that they were invariably in close ecological association with the millipede *Xystocheir francisca* Chamberlin, both living and as bleached exoskeletal remains of devoured individuals.

Laboratory cultures verified the suspicion of an intimate predator-prey relationship, and revealed much ethological similarity between the two Carabid genera regarding their feeding mechanism. Attack upon the millipedes occurred either at dusk or nightfall, all being relatively inactive and hidden beneath stones and debris during the day. Both *Promecognathus* and *Metrius* kill by severing the ventral nerve cord immediately posterior to the head, and then proceeded to desegment and devour the body. Millipedes, other than *Xystocheir*, were ignored, although both accepted raw meat, and a *Promecognathus* adult was observed in the field feeding upon a Tipulid larva. As both predators and prey are subterranean in habit for a greater part of the year it is assumed, on the basis of known Carabid biology, that the larvae of both *Promecognathus* and *Metrius* feed upon the young millipedes in the soil, which are often found at depths of a foot or more.

The known distributions of the beetles are considerably greater than that of the millipede, and it is not known what these Carabids prey upon outside of the range of *Xystocheir francisca* Chamberlin. It is of interest, however, to note that the close phylogenetic position of *Promecognathus* and *Metrius*, based both upon adult and larval morphology, is further borne out by the similarity in their general biology and unusual feeding habits within the area of sympatry.

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THE RAYMONDIONYMINE WEEVILS OF CALIFORNIA, WITH A DESCRIPTION OF A NEW GENUS, AND SEVERAL NEW SPECIES

(Coleoptera: Curculionidae)

EDWARD E. GILBERT

University of California, Berkeley

An investigation of the distribution of the weevil, *Shizomicrus* Casey, in the northern California coastal redwood forests has led to the discovery of a new genus, with two new species, and two new species of the Old World weevil genus *Raymondionymus* Wollaston. In order to trace the possible evolution of the Raymondionyminae, an attempt has been made to evaluate the morphological characteristics of the new genus and species and to correlate these with existing New and Old World related genera. In the course of this study, morphological evidence has suggested that *Shizomicrus* is best regarded as a subgenus of *Raymondionymus*.

Alaocybites Gilbert, new genus

Body elongate, moderately convex, not depressed, covered with sparsely placed, erect, yellow hairs, which form single series on the elytral intervals; punctures usually encrusted with dirt. Head globular; eyes wanting; beak evenly arcuate; four-fifths the length of prothorax; viewed laterally, equal in thickness throughout, the base dorsally separated from the head by a slight constriction; viewed dorsally, base of antennal insertion prominent as a small arcuate ridge, which begins at apical lateral margin of beak, becomes dorsally sinuate, to form the basal margin of apical half of scrobe; viewed ventrally, without a median carina; scrobes deep, almost straight, bordered dorsally by a small carina. Antennae inserted at apical third, insertion visible from above; scape elongate claviform; attaining side of head; funicle seven-segmented; club obconical, first segment subequal to one half total length, the sutures marked by dense decumbent hairs; antennal hairs becoming increasing more dense distally. Prothorax straight, or slightly flexed upward; pronotum longer than wide, greatest width at middle, apex and base equal in width; pronotal punctures large, slightly separated, except along apical margin where there is a band of smaller punctures; band laterally narrower, mid dorsally extended more posteriorly. Scutellum absent. Elytra subconnate; the bases broadly and arcuately emarginate, not receiving the prothorax; humeral angles rounded, not prominent; elytral length more than twice that of prothorax, less than twice their combined width, which is less than twice that of prothorax at widest point; sides evenly subarcuate to greatest width at middle; strial punctures large and deep; intervals narrower than striae, slightly elevated, convex, with small punctures in a single series, distantly separated, each with an erect yellow hair arising from the center. *Prosternum* long, tumid before coxae to at least apical fourth. Mesosternum slightly depressed anteriorly. Meta-

and meso- sterna moderately convex, together shorter than prosternum. Sternal punctures deep, only slightly separated, usually laterally coalesced medially. Abdomen long, the first two segments long, subequal, separated by a fine suture, at least feebly impressed in female, strongly in the male; third, fourth and fifth sutures deeply impressed, so that both third and fourth segments, when viewed laterally, are anteriorly impressed, and form oblique angles with the rest of the abdomen, fifth segment as long as the third and fourth combined; punctures on the first and second abdominal segments large and deep, slightly separated laterally, widely so medially; punctures smaller on the third and fourth abdominal segments and arranged in lateral rows; punctation extremely fine, surface more glabrous on fifth abdominal segment, which is more translucent, and covered with sparsely placed erect yellow hairs, that are similar in length and insertion to those on elytral intervals. Other pubescence on venter white, very fine, and originating from the side of large punctures. Legs long; coxae with sparsely placed erect, yellow hairs, similar to those on elytra and fifth abdominal segment; fore coxae contiguous, mid coxae subcontiguous, hind coxae separated by their own width; femora slightly clavate, deeply and coarsely punctate, not grooved ventrally, hind femora flattened interiorly; tibiae long, slightly compressed, strongly rugose in sculpture; grooved dorso- apically for reception of tarsi; fore tibiae elongate wedge-shaped, external apical margin round, carinate and fimbriate; the internal angle slightly dilated and mucronate; mid and hind tibiae more subparallel, internal lateral border of tarsal grooves fimbriate; ventral tibial apical angle not dilated, but mucronate; tibial apices crowned with minute teeth. Tarsi small, the first three segments subequal; third segment not dilated, but apically emarginate; fourth tarsal segment less than one half longer than third. Pubescence on the legs increasing in density distally, very dense on tarsi. Claws simple, free and divergent.

Type of genus: *Alaocybites californica* Gilbert, new species.

A comparative discussion of the specific and generic characters, and the probable interrelationships of the New and Old World Raymondionyminae is presented towards the end of this paper. Suffice it to say, the genus *Alaocybites* is close to the European *Alaocyba* Perris. It differs from *Alaocyba* by having the body moderately convex rather than depressed, the antennal scrobes directed along the side of the beak rather than directed under the beak, the antennal funicle with seven rather than six segments; the area before the fore coxae tumid rather than convex, the metasternum anteriorly depressed instead of being on the same plane with the other sterna, and by having the mid and hind tibiae, as well as the fore tibiae, simple instead of broadly and triangularly dilated.

Alaocybites has been found in redwood litter in the northern

coast district of California, from Mendocino to Del Norte County, and includes the following two species.

Alaocybites californica Gilbert, new species

(Plate I, A-C)

Body shining; head, coxae, fifth abdominal segment, prothorax, and distal appendages shining, translucent, light red-brown, rest of body darker and more opaque; pronotum with a subapical and basal, elytra with basal, black border. Head subglabrous, finely and sparsely punctured, without setae; head, viewed dorsally, not at all hidden by pronotum; beak with median subimpunctate line, lateral punctures linear striate from base to antennal insertion; scrobes completely lateral; antennae with first segment shorter than second and third combined, third through seventh segments equal in length and gradually wider. Prothorax with anterior lateral margin sinuate and almost horizontal; pronotum sinuate apically, sides evenly arcuate, feebly constricted apically and basally; pronotal punctures slightly, but not uniformly separated, apical band of small punctures narrow, limited to margin except mid dorsally, where they are slightly extended posteriorly. Elytra with sides from middle to apex narrowly arcuate, not at all constricted; punctures on humeral angle confused. Prosternum tumid to apical fifth, apical margin merely sinuate, not deeply and arcuately emarginate. Distal half of hind tibiae with posterior lateral margin sinuate, carinate towards apex and with fimbriae bordering margin. Length, excluding beak, 2.3 mm., width 0.8 mm.

Although the type specimen is one of the lighter, and more shining individuals of the series before me, the banding of the pronotum and elytra remain consistent. In darker individuals the pronotum may become similar to the elytra in both coloration and opaqueness. The pronotal apical band of small punctures is feebly developed in the mid dorsal area of the type, but in other individuals the mid dorsal punctures may extend posteriorly to the apical fifth, and delimit an area triangular or semi-circular in form. There is a variation in length from 1.7 mm. to 2.9 mm., and in width from 0.6 mm. to 1.1 mm.

Holotype female and allotype male (Calif. Acad. Sci., Ent.) and twenty-two paratypes. The holotype and one paratype collected August 13, 1953 by G. A. Marsh and R. O. Schuster, the allotype and five paratypes collected September 19, 1953 by R. O. Schuster and E. E. Gilbert 18 MILES SOUTH OF KLAMATH, DEL NORTE COUNTY, CALIFORNIA. Ten paratypes collected March 7, 1954, one paratype collected July 29, and one paratype collected July 31 by J. Helfer at Caspar, Mendocino County, California. Four additional paratypes: one from Mendocino, December 19, two from four miles east of Fort Bragg, December 24, and one

from Navarro ridge road, December 26, 1954 all collected by J. Helfer in Mendocino County, California.

The paucity of specimens from Del Norte County does not reflect collecting for only eight specimens were taken from over two hundred pounds of litter. In Mendocino County sixteen specimens were taken from less than one hundred pounds of litter. This may reflect that the deeper litter, in which the specimens were collected, is more abundant and widely distributed in Del Norte than Mendocino County, or that the species is reaching the northern limits of its distribution. The latter is deemed more evident from the geographic location of the following new species.

Alaocybites rothi Gilbert, new species

Body dull, antennae and distal appendages, shining, translucent, light red-brown; head, coxae, and fifth abdominal segment light red-brown, but more opaque and finely rugose, rest of body darker; prothorax with a band of light red along apical margin, that is triangular in form, widest medially, extending there to apical fifth; both pronotum and elytra without distinguishable black borders. Head closely punctate, with fine sparsely placed setae; head view dorsally, almost completely hidden by pronotum; beak without a median subimpunctate line, uniformly coarse and rugose to antennal insertion; antennae with first segment larger than second and third combined, second only slightly larger than third, third through seventh subequal in length and width. Prothorax with anterior lateral margin straight, and horizontally oblique; pronotum subtruncate apically, apical fifth constricted, parallel, abruptly swollen from apical fifth to middle, then evenly arcuate to base; pronotal punctures subcontiguous, apical band of small punctures wide, limited to constriction, except mid dorsally, where they extend posteriorly slightly beyond constriction. Elytra with sides from middle to apex broadly arcuate, constricted near apex; punctures on humeral angle linear, not confused. *Prosternum* tumid to apical fourth, apical margin deeply and arcuately emarginate. The first and second abdominal segments more deeply impressed than *A. californica* in both sexes. Distal half of posterior lateral margin straight, fimbriae distally curving medially, not following the posterior margin. Length, excluding beak, 2.3 mm., width 0.9 mm.

This species appears to be generally more uniform in size and coloration than *A. californica*. Although there is some variation in the length of the antennal segments, *A. rothi* can be

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PLATE I

Figs. A–C *Alaocybites californica* Gilbert. A, lateral view; B, dorsal view, with head and beak elevated; C, ventral view. Figs. D–E. *Raymondionymus* (Shizomicrus) *caecus* (Casey). D, lateral view; E, dorsal view, with head and beak elevated; F, ventral view. Magnification 21 times.

ALAOCYBITES CALIFORNICA GILBERT

RAYMONDIONYMUS (SHIZOMICRUS) CAECUS (CSY.)

readily distinguished from *A. californica* by its uniform dull luster, dense pronotal punctation, and probably most noticeably, by the insertion of the head into the prothorax, with the accompanying obliqueness of the anterior lateral margin of the prothorax. The latter characters bring the genus more in accord with the rest of the Raymondionyminae, where the head is concealed, and the oblique lateral margin of the prothorax sometimes approaches an almost horizontal position. There is a variation in length from 1.8 to 2.6 mm., and in width from 0.7 to 0.9 mm.

Holotype female and allotype male (Calif. Acad. Sci., Ent.) and thirty-one paratypes collected November 21, 1953, TWO MILES NORTH OF FORT DICK, DEL NORTE COUNTY, CALIFORNIA. The species was collected by Mr. V. D. Roth. Thirty-three specimens were taken from less than fifty pounds of redwood litter.

Genus RAYMONDIONYMUS Wollaston

Although the scope of this genus has apparently been adequately defined, by Ganglbauer, 1906, to include the Old World species, it does not fully include the characters of the related American species. In fact, in one of the following two species, there is not only a marked divergence from the Old World *Raymondionymus*, but also a convergence towards *Aloacyba*, and *Alaocephala* Ganglbauer. Thus, in order to give a full discussion of the characters of the American species, and their discrepancies with the Old World *Raymondionymus*, these characters will be treated following the descriptions, where full use of the specific and individual variation can be employed.

Raymondionymus schusteri Gilbert new species

(Plate II, figs. G-I)

Body very small, shining, narrowly elongate oval, moderately convex above, covered with sparsely placed, erect, pale yellow hairs, which are confused, and do not form single series on the elytra. Head, beak, antennae, femora, third, fourth and fifth abdominal segments ochraceous, rest of body amber; prothorax and elytra dorsally translucent and shining, the venter opaque and dull. Head glabrous, not visible from above, finely and sparsely punctured; beak three-fourths length of prothorax; strongly constricted basally; dorsally asperate and feebly punctate to antennal insertion, slightly thickened basally before constriction, and with carina above antennal insertion small, only slightly laterally prominent at apical third; laterally, subconnate to antennal insertion, then dorsal lateral margin abruptly bent and obliquely angulate in apical third; ventrally trianguliform, broadest at antennal insertion, terminating without a carina at basal fourth of beak; scrobes completely inferior, straight, attaining venter of

head, with dorsal border sinuate, slightly cariniform; antennae inserted slightly before middle, insertion latero-ventral in position; scape robust, claviform, almost attaining venter of head; funicle five segmented, the first segment more robust and longer, second through fifth subequal. Prothorax with anterior lateral margin obliquely horizontal and straight, but basally emarginate; pronotum subovate, widest medially, feebly constricted basally, strongly so apically, the apical constriction demarcating an elevated area,

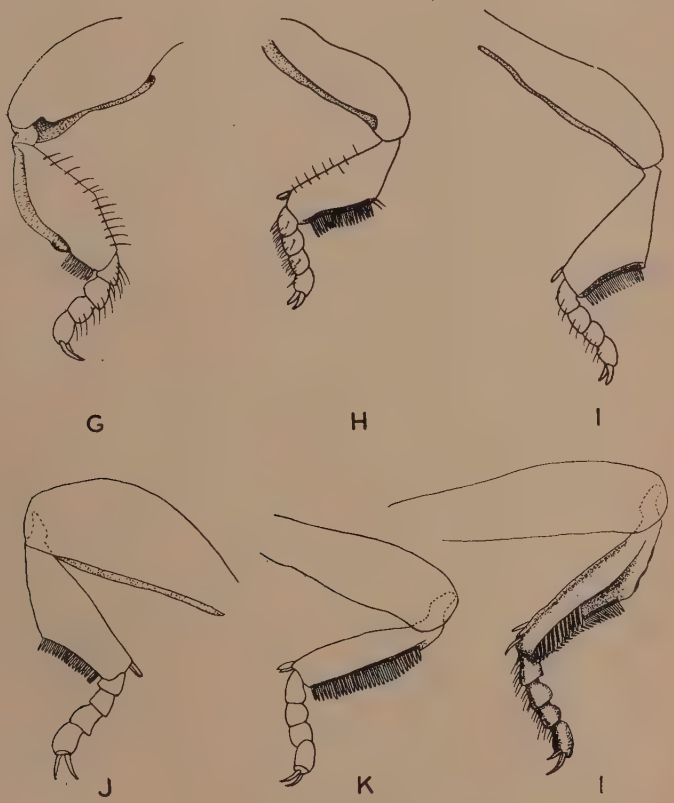

PLATE II

Figs. G–I. The legs of *Raymondionymus schusteri* Gilbert. G, external face of the fore leg; H, internal face of the mid leg; I, internal face of the hind leg. Figs. J–L. The legs of *Raymondionymus helferi* Gilbert. J, external face of the fore leg; K, internal face of the mid leg; L. internal face of the hind leg. Magnification 100 times.

laterally restricted to apical fifth, but mid dorsally gibbosely extended in the form of a hemisphere to apical three-eighths; pronotum coarsely and closely punctate, but without a mid basal coalescence or groove, or medial impunctate area. Scutellum absent. Elytra widest medianly, humeral angles rounded, the base angularly emarginate mid dorsally, sides subconnate to middle, then broadly arcuate to apex, with a slight constriction subapically; apically conjointly rounded; striae and intervals obsolete. *Prosternum* with mid apical margin broadly emarginate; triangularly depressed before coxae, the apical margin widest, with apical extremity of depression declivous only slightly basal to apical prosternal border, lateral border of depression broadly tumescent. Mesosternum only slightly anteriorly depressed. Abdomen with two segments deeply impressed medially; the lateral abdominal margin only slightly constricted between second and third abdominal segments. Legs short, moderately robust; fore coxae subcontiguous, mid coxae barely separated by their own width, hind coxae widely separated; fore femora more robust, mid and hind femora less so, all femora feebly punctate and shining, grooved ventrally for reception of tibiae; tibiae externally triangu-liform; fore tibiae short, robust, externally broadly carinate, mid tibiae subequal in length, compressed, hind tibiae longer, greatly compressed. The external angle of the trianuliform tibiae fimbriate on inner margin of all pairs; all tibiae pubescent, but mid tibiae more densely so. Length, excluding beak, 1.1 mm., width 0.4 mm.

Although the translucency remains fairly constant, the body coloration varies from almost completely ochraeceus to almost uniformly amber, though the antennae tend to remain more ochraeceus. The antennal funicle varies conspicuously, for the first funicular segment may vary in length from half again as large to over twice as large as the second segment, and may also vary in thickness from almost subequal to extremely robust in respect to the second segment. The lateral apical margin of the prothorax varies from straight to broadly sinuate, while the elevated pronotal area may be very prominent, as in the type, or may be nearly obsolete. The lateral margins of the prosternal depression may vary from weakly tumescent to subcarinate. The sexes may be differentiated by the impression of the first and second abdominal segments. Generally males have these segments strongly medially depressed, while females either lack or have only a feeble depression, but there is some overlapping. There is a variation in length from 0.9 to 1.3 mm., and in width from 0.3 to 0.5 mm.

A similar combination of a posternal groove, laterally bordered by a tumescent fold; a five segmented antennal funicle, and subcontiguous fore coxae exists in the European *Raymondionymus benjamini* Marquet. However, *R. schusteri* can be distinguished

than that of the type, so that only the antennal club is ochraeceus. The area between the dorsal lateral carina of the beak and the dorsal carinate border of the scrobe may be either smooth and shining, or roughened as it is in the type, but where the surface is smooth, the coloration is usually more ochraeceus. The same general variation in antennae, lateral apical prothoracic margin and pronotal elevated area that occurs in *R. schusteri* also appears in this species. However, the lateral borders of the prosternal depression tend to be more tumescent or carinate than in the former species. The mid coxae are described as being separated by less than their width, but his varies, and individuals with the mid coxae separated by their own width are not uncommon. The most noticeable variation concerns the position of the ventral grooves of the fore femora. In the type and part of the series these grooves appear almost as in *R. schusteri*, but may be placed on either the internal or external face of the femora. As previously stated, the mid femora have less of a groove, for while the interior border is complete, the external border is lacking, except at the apex. Although the hind tibiae are also apically grooved, and have the interior border complete, and the exterior border lacking, the intervening area is flattened instead of hollow. However, the position of these areas on both the mid and hind femora is relatively stable. There is also some variation in the size and shape of the tibiae; the degree of constriction of both the beak and prothorax, and the degree of punctation. There is a variation in length from 0.9 to 1.6 mm., and in width from 0.4 to 0.6 mm.

Holotype male and allotype female (Calif. Acad. Sci., Ent.) and two hundred and eighty-eight paratypes. One hundred and eight paratypes from Mendocino, Mendocino County, California, February 14, 1954. The holotype, allotype, and two hundred and eighty paratypes from Caspar, Mendocino County, California, March 7, 1954. The entire series was collected by J. Helfer, after whom the species is named.

The combination of characters exhibited by this species does not approach any particular European species, but rather tends to be intermediate between the Old World genera. For example, while the antennal scape extends beyond the basal constriction of the beak as in *Alaocyba*, the scrobes are slightly oblique and thus intermediate between *Alaocyba* and *Raymondionymus*, the

but finely rugose to antennal insertion, and with lateral carina above antennal insertion, dorsally prominent as a small knob, extending posteriorly along the lateral margin to the basal constriction as a small carina; laterally, subconnate to antennal insertion, then dorsally slightly bent to apex; ventrally trianguliform, broadest below antennal insertion, terminating in a carina near base of beak; scrobes slightly oblique, directed under beak, attaining the head ventrally, the dorsal lateral margin sinuate, slightly cariniform, and ventrally delimiting a small obliquely angular depressed area between this carina and the dorsal lateral carina of the beak; antennae inserted slightly in front of middle; insertion dorso-lateral in position; scape short, robustly claviform, attaining venter of head; funicle five segmented, the first segment longer, and slightly more robust, the second through fifth short, subequal. Prothorax with anterior lateral margin obliquely vertical, and broadly sinuate, basally truncate and emarginate; pronotum subelliptical, slightly constricted at apical fourth, delimiting a feebly elevated area that extends mid dorsally to apical third; very feebly constricted at basal third; pronotum coarsely and closely punctate, the punctures coalescent mid basally, forming a short medial groove. Scutellum absent. Elytra widest medianly, broadly and angularly emarginate basally, sides subconnate to middle, then broadly arcuate to apex, with a slight constriction near apex, apically conjointly rounded; length twice that of prothorax, less than twice their combined width; intervals and striae not confused, intervals subequal to striae, feebly raised, convex, shining, with small punctures distantly separated in a single series, each with an erect, pale yellow hair arising from the center; striae with punctures deep, separated by half their own width with ridges confluent with intervals. *Prosternum* with mid apical margin broadly emarginate and arcuate, deeply and triangularly depressed before coxae, the depression widest subapically, and bordered there by an abrupt declivity; the lateral borders of the depression strongly carinate. Mesosternum strongly depressed anteriorly. Abdomen with first two segments deeply impressed medially; the lateral abdominal margin constricted between the second and third abdominal segments. Legs short, moderately robust; fore coxae subcontiguous, mid coxae separated by less than one-half their own width, hind coxae widely separated; femora finely punctate and shining, except fore femora externally; fore femora more robust, grooved ventrally for reception of tibiae; mid femora less robust, hollow ventro-laterally; hind femora less robust than the fore, with a ventral groove near apex, the rest with the anterior edge angularly prominent, the internal edge reduced; thus appearing ventrally wedge-shaped; tibiae finely punctate and shining; fore tibiae robust, short, trianguliform; mid tibiae subequal in length, subparallel, not compressed; hind tibiae narrowly and obtusely trianguliform, not compressed. The fimbriae prominent on the internal margin of the fore tibiae, and on both the internal and external margins of the mid and hind tibiae. Length, excluding beak, 1.4 mm., width 0.5 mm.

The opaqueness and coloration of the dorsal surface remains constant, but the color of the appendages may be uniformly darker

from the former species by having a shorter more robust beak, which lacks a ventral carina, with the antennae inserted near the middle instead of near the apex, by the confused elytral punctation, and by having the fore tibiae carinate.

Holotype male and allotype female (Calif. Acad. Sci., Ent.) and twenty-two paratypes. One paratype from Alpine Lake, Marin County, California, June 18, 1953, collected by R. O. Schuster and C. D. MacNeil; the holotype, allotype, and twenty-one paratypes were collected NEAR THE SOUTH ENTRANCE OF SAMUEL P. TAYLOR STATE PARK, MARIN COUNTY, CALIFORNIA, in the following sequence of dates, by the following collectors: three paratypes collected October 24, 1953 by V. D. Roth; the holotype, allotype, and thirteen paratypes collected November 1, 1953 by R. O. Schuster, V. D. Roth, and E. E. Gilbert; five paratypes collected November 8, 1953 by R. O. Schuster, G. A. Marsh, V. D. Roth, and E. E. Gilbert.

The holotype, allotype, and ten paratypes, of the fifteen specimens collected November 1, 1953, were taken from the interior of a redwood log which was in the last stages of decay. Thus over half of the material collected came from about five pounds of decayed redwood from part of a log, while over one hundred pounds of litter collected from the floor of the redwood groves, and alongside the bases of healthy trees, yielded only ten specimens. The only teneral specimen taken, was collected on the floor of the redwood grove, and probably emerged in the litter while the latter was in the laboratory, since the material was retained a few days before it was placed in a berlese funnel.

This species is named after R. O. Schuster, who either directly through collecting, or indirectly, with the use of berlese funnels, supplied the major portion of the material included in this paper, and who also prepared the majority of the specimens for study.

Raymondionymus helferi Gilbert, new species

(Plate II, figs. J-L)

Body small, narrowly elongate oval, moderately convex above, covered with sparsely placed erect pale yellow hairs, which form single series on elytral intervals. Antennae and tarsi ochraeceus, rest of body red-brown, head and appendages lighter and more shining, except fore femora, which, externally, like the rest of body, is darker and uniformly dull. Head glabrous, feebly shining, with large sparsely placed punctures; not visible from above; beak two-thirds as long as prothorax, constricted basally; dorsally, slightly constricted near middle, widest before base, impunctate

hind femora exhibit ventrally a vestige of the groove present in *Raymondionymus*, and completely absent, on all femora, in both *Alaocyba* and *Alaocephala*. The ventral carina of the beak, absent in *Alaocyba*, and also *A. schusteri*, is present only at the base of the beak, and thus intermediate between *Alaocyba* and *Alaocephala* and *Raymondionymus*. The mesosternum is depressed strongly as in *Raymondionymus*, not only slightly as in *Alaocephala* and *R. schusteri*. This species differs from the rest of the Raymondionyminae by possessing a double row of fimbriae on the mid and hind tibiae. However, considering these discrepancies, the presence of a moderately convex body, a beak with a ventral basal carina, a five segmented funicle, strongly depressed pro- and mesosterna, and ventral femoral grooves, complete at least on the fore femora, provides a strong indication that this species is more closely related to the genus *Raymondionymus* than to other European genera. This species may be readily distinguished from other species of *Raymondionymus* by the characters listed above.

RAYMONDIONYMUS (SHIZOMICRUS) CAECUS Casey

(Plate I, D-F)

A collection of nearly one hundred and fifty specimens of this species has indicated that there is a large degree of variability, not only in size, but in characters found to be variants in both *R. schusteri* and *R. helferi*. Thus there is a conspicuous variation in antennal segmentation, such that the form may vary from a moniliform segmented funicle to a strongly clavate one, the second and third funicular segments may be either conspicuously narrower or subequal to the rest of the funicle. The dorsal lateral margin of the prothorax may vary from straight to broadly sinuate, while the pronotal sculpture may vary from sparsely to heavily and closely punctate; the elevated area of the pronotum may vary in a manner similar to *R. schusteri* and *R. helferi*. The fore femora may be completely grooved, or only anteriorly grooved and posteriorly carinate, with the external surface broadly impressed. The prosternal sulcus varies only in degree, and remains carinate throughout the series. There is a variation in length from 1.1 to 2.6 mm., and in width from 0.5 to 1.4 mm.

The range of distribution of this species extends from Navarro ridge road, southern Mendocino County, where it was collected with *Alaocybites californica*, southeastward to Napa County, and southward to lower Santa Cruz County. The species is fairly abun-

dant in redwood litter throughout the year, and although it appears to replace *Alaocybites* geographically, it is as abundant in very shallow dry as well as deep litter. The type was collected by Mr. Charles Fuchs, and recorded by him as collected at Samuel P. Taylor State Park, Marin County.

R. caecus, except for the seven-segmented antennal funicle, resembles the Old World species of *Raymondionymus* very closely. Like *Raymondionymus,* the scrobes are inferior, separated by a long carina, the antennae does not pass the base of the beak, the prosternum is grooved, the mesosternum strongly anteriorly depressed, the femora all grooved ventrally to receive the tibiae, and the tibiae are all dilated and fimbriate, the mid and hind tibiae being very strongly compressed. Since *Raymondionymus* has species with both five and six segmented funicles, the generic status of *Shizomicrus* Casey, based as it is on a seven segmented funicle, is considered no longer valid, and *Shizomicrus* is therefore regarded as a subgenus of *Raymondionymus.*

The Generic Limits of Raymondionymus

Mainly because of a lack of specimens of both *Alaocyba* and *Alaocephala,* the morphological evidence derived solely from the California species does not warrant either the proposal of a new genus, nor the synonomy of *Alaocephala.* Genitalic characteristics of the American species have not been discussed, though they appear to provide good criteria, because they could only be correlated with those of the Old World *Raymondionymus.* Perhaps, with the European material, and a more complete representation of the American species, a comparison of New and Old World species could be undertaken. At the present time, however, it seems wiser to merely broaden the generic limits of the genus *Raymondionymus* to include the California species. Nevertheless, in doing so, certain characters can be best explained in reference to *Alaocyba* and *Alaocephala,* but in these cases the degree of difference will remain uncertain.

Although the differences of both *Raymondionymus schusteri* and *R. helferi* with the Old World *Raymondionymus* are actually few in number, they combine characters, used by Ganglbauer, to separate the European Raymondionymine genera. Further, the combination of these characters is different in each California species. For example, in *R. schusteri* the scrobes are ventral, like *Raymondionymus,* but not separated by a carina, a characteristic

of *Alaocyba*. However, in *R. helferi* the scrobes are oblique, like *Alaocyba*, but separated ventrally by a carina, as in *Raymondionymus*. Again, in *R. schusteri* the femora are all ventrally grooved, like *Raymondionymus*, while the mesosternum is only slightly anteriorly depressed, a feature of *Alaocephala*. In *R. helferi* only the fore and mid femora are grooved, and it is thus intermediate between *Raymondionymus* and both *Alaocyba* and *Alaocephala*, while the mesosternum is strongly depressed, as in *Raymondionymus*. Both *R. schusteri* and *R. helferi* have the antennae inserted just before the middle so that the scape, even though short, passes the basal constriction of the beak, like *Alaocyba*. A possible explanation for variation in beak characters, that are stable in the Old World genera, may involve the position of the scape, when the weevils are in their death feinting pose. In *R. caecus* and the Old World *Raymondionymus* the scape does not attain the basal constriction of the beak, and thus, when the head and beak are rotated ventrally, the scape cannot touch the prothorax. However, in both *R. schusteri* and *R. helferi* the scape passes the basal constriction of the beak, and when the head and beak are rotated ventrally, is held in repose between the emarginate basolateral apex of the prothorax and the lateral dorsal carinate margin of the scrobe. Therefore when the antennal scapes pass the basal constriction of the beak there is a tendency towards, either loss of the ventral carina of the beak, *R. schusteri*, acquisition of oblique scrobes, *R. helferi*, or both, *Alaocyba*.

That these two species are close to *Raymondionymus*, and not to the other Old World genera is attested by the grooved femora, at least in one pair of legs, the relatively convex body, and the depressed prosternum. Also, the fact that the characters which resemble the other Old World genera, are in a different combination, part of which reflects the genus *Raymondionymus*.

The Evolution of the Raymondionyminae

(Fig. 1)

Several morphological trends are evident in the Raymondionyminae. It seems fairly obvious that in the genus *Alaocybites* many of these either initiate or terminate. For example, the head, which at most is only partly visible in other Raymondionyminae, becomes completely visible in *A. californica* (Plate I, B), while the beak is slightly longer in this genus than in any other. The antennal scrobes are completely lateral in this genus, and the

funicle is seven segmented; in *Alaocyba* and *R. helferi* the scrobes are oblique, and the funicle is six and five segmented respectively. The remaining Raymondionyminae have the scrobes completely ventral, and the funicle segmentation may vary from seven *(R. caecus)* to five segments. *Alaocybites* has the area before the fore coxae tumid, while in *Alaocyba* and *Alaocephala* this area is simple, but usually deeply impressed or sulcate in *Raymondionymus*. *Alaocybites* possesses the most simple leg type, for the tibiae are not broadly dilated, and the femora not ventrally grooved; also, the abdominal segmentation is distinct, the third, fourth, and fifth sutures being more distinctly impressed. There occurs, in some species, a few characters which approach a "simple" condition, but corallary characters denote an origin manifestly different. Probably the best example of this is shown in the development of the subparallel mid-tibiae of *R. helferi*. In this species the tibiae are not dilated, which might indicate the reverse process had taken place, that is proceeding from a primitive dilated to the more advanced undilated condition, if it were not for the

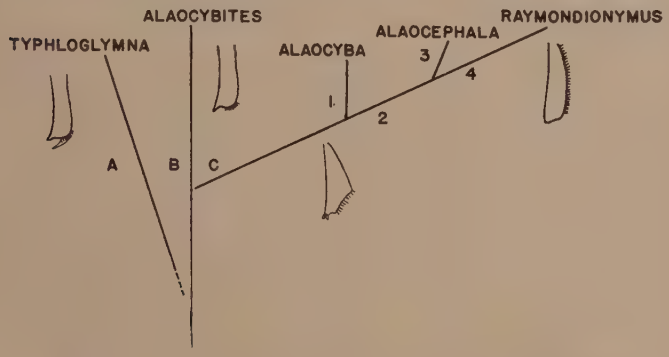

Figure 1. The theoretical relationships of the subfamily Raymondionyminae, with a key to the genera.

A. Tibial spurs present, tarsi with small ventral pads (Hylobiinae, Anchonini).

B. Tibial spurs absent, tarsi without ventral pads (Raymondionyminae). Tibiae not dilated; scrobes completely lateral.

C. Tibiae dilated; scrobes either (1) directed obliquely under beak, not separated by a carina ventrally, or (2) completely ventral, or if directed obliquely downward, separated by a carina ventrally. All femora grooved ventrally: (3) at apex, or (4) throughout, for the reception of the tibiae.

fimbriae. This development is illustrated by figure 1, where the tibiae are drawn diagramatically in a series from *Alaocybites* to the mid-tibiae of *R. helferi* (also figured on Plate II. fig. K). Here the fimbriae follow the external apex of the tibiae in *Alaocybites*, bordering the external groove for the reception of the tarsi. In *R. caecus* the same is true, except that the external angle of the tibiae has become greatly dilated. and compressed. This is true in *R. schusteri* (Plate II, figs. G–I) as it is in most of the Raymondionyminae. Where the tibiae become only narrowly triangular, the external angle may be extended basally. This can be seen in the hind legs of *R. helferi* (Plate II. fig. 1). Along with this modification there is a development of two rows of fimbriae, which serve in the same manner as the external groove of *Alaocybites*. The further development in the mid legs of the latter species is merely an increase in the external flattening. where the fimbriae follow the external angle almost to the base. This general evolutionary trend may also apply to the fore legs of some of the Old World Raymondionyminae (*Alaocyba*. *R. marqueti* Aubé, *R. stygius* Rost). The development of the beak. antennae. and prosternum could be similarly. but not as completely. followed. However. evidence for the development of the ventral femoral grooves is completely lacking. and what evidence that can be seen. points in the opposite direction. As was previously shown. *R. helferi* shows this process in operation. In fact. it is not improbable that the progenitors of *Alaocybites* did have femoral grooves, for there is no direct correlation between these and the tibial dilation. as evidenced by *Alaocyba* and *Alaocephala*, which lack complete grooves. but have the tibiae dilated. From this evidence *Alaocybites* appears to be more primitively derived. while *Alaocyba* and *Alaocephala* were apparently derived from a stock. which in many respects. was more similar to the modern *Raymondionymus*, especially *R. caecus*.

The only genus found that appears close to this group is *Typhloglymna* Dury. currently placed in the Anchonini of the Hylobiinae. Many Raymondionymine characters are present in this genus. For example, the head is partially inserted in the prothorax. and is smooth and glabrous, the beak is not externally dilated. but strongly constricted basally, the antennae are inserted near the apex. the scutellum is absent; the pronotum and elytra

are similar in shape, measurements, and setation, while the position of the coxae are well within the Raymondionymine limits. The tibiae are externally fimbriate (Fig. 1), and the abdomen is very similar to *Alaocybites*. Some of the other characters are close to individual Raymondionymine species. As in *R. helferi*, the scrobes are oblique and separated ventrally by a carina, but the antennal scape does not pass the basal constriction of the beak, as in *R. caecus*, and the Old World *Raymondionymus*. The antennal funicle is seven segmented, like *Alaocybites* and *R. caecus*. The tibiae are not only undilated as in *Alaocybites*, but similarly rugosely sculptured. However, *Typhloglymna* lacks the external tibial groove. Although the abdomen, like *Alaocybites*, has the third, fourth and fifth sutures deeply impressed, the third and fourth abdominal segments are not similarly angularly impressed. The setation is very similar to the Raymondionyminae, and thus includes fine, sparsely placed, erect, yellow hairs on the elytral intervals (in a single series), the fifth abdominal segment, and on the coxae. However, these hairs are more evident on the venter than those of the Raymondionyminae studied.

However, there are two main, and supposedly basic, differences that do not permit this genus to be included in the Raymondionyminae. The first is the presence of a well-developed recurved tibial spur, lacking in all Raymondionyminae; and the second, the tarsi. The tarsi in the Raymondionyminae are very unique. The segments are large, and subcuboid, the fourth being only slightly longer than the third in length, and subequal to the other segments in thickness. The segments are covered with a long and fairly dense pubescence, but lack completely any ventral pads. In *Typhloglymna*, however, the tarsi are like those of the majority of the Hylobiines, being small, and elongate, with the fourth segment long and very slender. The segments have small lateral ventral pads of short pubescence, and lack the long hairs common to all Raymondionyminae.

In addition, there is a marked similarity between *Typhloglymna* and the Raymondionyminae, and even though its characters are not consistent with any particular species, these characters are expressed in other combinations within this subfamily.

On the present evidence, it would be impossible to derive the Raymondionyminae from the Anchonini of the Hylobiinae, but I believe the closest relationship lies in this group. It would be

wise, therefore, to place the Raymondionyminae in the Curculionidae, immediately following the Hylobiinae, on the presumption that although there can be seen no direct line of evolution.

Acknowledgements

I would like to thank R. O. Schuster for collecting and preparing a large part of the material used in this study, and H. B. Leech for furnishing additional material of American and European representatives of the group. Thanks are also due to Mrs. Abernathy for illustrating the species on Plate I, and to Dr. M. B. Sanderson for furnishing a specimen of *Typhloglymna* for study.

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SEVERAL NEW SPECIES OF WESTERN TRICHOPTERA

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Recent collections of caddisflies studied by the writer have revealed several new species and some interesting distributional records. Six new species in the Rhyacophilidae, Philopotamidae and Psychomyiidae are described herein. All of the new species described are from the western montane region. Unless indicated otherwise, types are in the collection of the writer.

Grateful acknowledgement is made to Dr. C. P. Alexander of the University of Massachusetts, the late Mr. Harry P. Chandler, and Mr. K. M. Fender of McMinnville, Oregon, for collecting and sending me the majority of the specimens studied in this paper.

Rhyacophila wallowa Denning, new species

This species is a member of the *vao-acropedes-inculta* complex. It can be separated from *vao*, its closest relative, by the abruptly constricted basal segment of the clasper, and by the narrow attenuated apical segment of the clasper. In this respect *wallowa* is similar to *acropedes* but differs in the absence of a mesal lobe of the ninth tergum.

Male.—Length 12 mm. Head, body and legs ferruginous, wings about same color except stigma darker and hyaline mottling along margin. *Genitalia* as in fig. 1. Ninth segment annular, approximately same width throughout although very irregular in outline; ninth tergum with no mesal projection, from lateral aspect dorsal margin arcuate. Tenth tergite divided into a pair of narrow blade-like lobes when seen from dorsal aspect, fig. 1B; from lateral aspect structure narrowed distally, slightly upturned. Clasper with basal segment wide at base, abruptly narrowed toward middle and then gradually widened; apical segment with basal heel narrow, distinctly set off from distally narrowed apical portion; when viewed from dorsal aspect mesal edge of apical segment flattened and covered with dense black spinules. Aedeagus with lateral extensile membranous arms terminating in a pad of dense minute reddish setae, fig. 1C; mesal plate between arms attenuated and tubular.

Holotype male, WALLOWA RIVER, WALLOWA COUNTY, OREGON, July 15, 1949, Grace H. and John L. Sperry.

The *Rhyacophila acropedes* complex contains four western species possessing a similar tenth tergite, clasper and lateral arms of the aedeagus. On the basis of the male genitalia these species may be separated as follows:

1. Ninth tergite with a prominent mesal process extending over a portion of tenth tergite 2

Ninth tergite without a mesal process 3

2. Basal segment of clasper wide throughout, apical segment of clasper with distal portion wide and rounded ..... *inculta* Ross
   Basal segment of clasper abruptly narrowed, distal portion of apical segment narrowed ..... *acropedes* Banks
3. Basal segment of clasper only slightly narrowed, heel of apical segment wide ..... *vao* Milne
   Basal segment of clasper abruptly narrowed, heel of apical segment narrow ..... *wallowa* Denning

Rhyacophila vao and *inculta* have a wide distribution throughout Western United States and Canada. *Rhyacophila acropedes* has a similar distribution but is also found in the New England States and Labrador with at present no intermediate distributional records available.

Rhyacophila chandleri Denning, new species

This species bears little resemblance to other described species. *Rhyacophila chandleri,* one of the more generalized species, can readily be separated from other species by the massive tenth tergite, the peculiar hammer-shaped dorsal structure of the aedeagus and the narrow quadrilateral apical segment of the clasper.

Male.—Length 10 mm. Wings light brown with several scattered luteous spots, the most conspicuous is triangular and located at the radial sector. Body, antennae and legs a trifle darker than wings. *Genitalia* as in fig. 2. Ninth segment slender throughout except for a wide emargination laterally to receive clasper. Tenth tergite superficially appears as an integral part of the ninth tergum, it is massive extending beyond basal segment of clasper, obtuse apex projected dorso-caudad; from dorsal aspect, fig. 2B, quadrate, distal margin widely emarginate; from ventral aspect mesal surface concave. Clasper with basal segment very wide at base, slightly longer than apical segment; apical segment approximately same width throughout, margins parallel-sided, apical margin circular, setae sparse. Aedeagus, fig. 2C, with dorsal portion deltoid and subacute, bearing internally an extrusible black spine; ventral portion tubular and short, bearing internally a fairly large reddish-brown structure which is partially extruded in the specimens examined.

Holotype male. SACRAMENTO RIVER, SISKIYOU COUNTY. CALIFORNIA. ELEVATION 3200 FEET, Sept. 9, 1953, H. P. Chandler. Paratype male, same data as for holotype. Holotype deposited in the collections of the California Academy of Sciences, San Francisco, California.

This species is named in honor of the late Harry P. Chandler, who not only collected this species but who also collected large numbers of aquatic insects from western United States. Through his collections and studies of aquatic insects Mr. Chandler made

many noteworthy contributions to our knowledge of the aquatic fauna.

Rhyacophila pichaca Denning, new species

This species may easily be distinguished from its nearest relative, *visor* Milne, by the slender acuminate lobes of the tenth tergite, by the narrow apical segment of the clasper and by the complex aedeagus which lacks the hook-like mesal process of *visor*.

Male.—Length 7 mm. Wings brownish, stigma of both pair of wings dark due to dense pubescence. Legs about same color as wings except the spurs of second and third pair which are dark brown. Body, head and antennae blackish. Sixth abdominal sternite with a short black spine, seventh sternite with prominent yellowish mesal tooth. *Genitalia* as in fig. 3. Ninth segment with sternum narrow, dorsal portion considerably expanded, ninth tergum extended caudad as a short, blunt hood-like angulation. Tenth tergite consists only of a pair of prominent lateral hook-like acuminate prongs, from dorsal aspect fig. 3B, prongs gradually convergent but not confluent. Basal segment of clasper shaped as a parallelogram, about same width throughout; apical segment short, directed ventro-caudad, dorsal corner round, apex narrowed and obtuse, setae sparse. Aedeagus fig. 3C, partially retracted into eighth and ninth segments, and presenting a complicated structure. It consists of: (1) a pair of dorsal semi-membranous structures, apically truncate, distal margins lightly sclerotized; (2) middle lobe heavily sclerotized, flattened and thin, distally abruptly curved dorsad, from ventral aspect apex bilobed; (3) a heavily sclerotized distally flattened structure, apex narrow and acute and bearing along lateral surface a pair of short, acute, membranous processes, from ventral aspect apex acute and attenuated.

Holotype male, Cascade Head Experiment Forest, Tillamook County, near Otis, Oregon, July 27, 1951, K. M. Fender. Paratype male, same data as for holotype. Washington: Olympic Hot Springs, Boulder Lake, July 20, 1953, C. P. Alexander, 1♂.

Rhyacophila lineata Denning, new species

In many respects this species is quite similar to *celina* to which it is related. However, certain details of the male genitalia, such as the tenth tergite, the apical segment of the clasper and the complicated aedeagus will easily distinguish this species.

Male.—Length 11 mm. Wings fuscous, with irregularly scattered hyaline areas, especially along margins, body and appendages trifle lighter in color, maxillary palpi considerably darker. Seventh sternum with short mesal spine. *Genitalia* as in fig. 4. Ninth segment irregular in outline, sternum narrower and only slightly indented to receive clasper. Tenth segment complex, consisting of (1) a short dorsal projection which appears triangular and pointed from lateral aspect, but from dorsal aspect, (1), fig. 4, structure projects

caudad as a quadrate flap: (2) next, a lightly sclerotized structure, distal portion slender, practically same width throughout, apex acute, from dorsal aspect, (2), fig. 4, appears as a narrow attenuated sclerite distally; ventral lobe wide covering most of structure, somewhat circular in outline; (3) next, a heavily sclerotized structure pigmented black along distal margin, apex blunt and curved dorsad; from dorsal aspect, (3), fig. 4, structure is bilobed, apices convergent; (4) ventral structure also heavily sclerotized, black pigmentation along apical margin, apex truncate, (4), fig. 4; from caudal view lateral lobes closely appressed forming a tubular structure. *Clasper* very short, both segments about same length, basal segment rhomboidal; apical segment ovoid, mesal surface concave, covered with heavy pubescence except near distal margin a line of no pubescence thus forming a distinct light-colored line. Aedeagus short, retracted into ninth segment and difficult to discern, consisting of two wide lateral sheaths, tapering distally, lateral lobes enclose a dorsal spine-like structure and a short ventral structure.

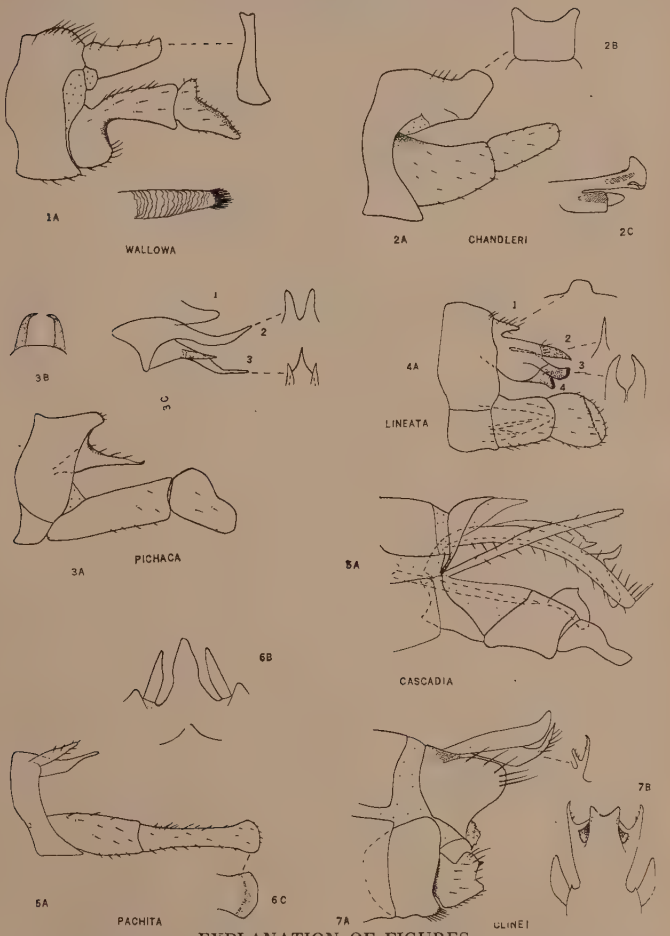
Holotype male. CASTLE CRAGS STATE PARK, SHASTA COUNTY, CALIFORNIA, June 13, 1950, *L. W. Quate*. Holotype deposited in collection of University of California, Berkeley, California.

Tinodes cascadia Denning, new species

This species is a member of the *parvula, signodana, siskiyou* complex and represents the seventh Nearctic species in the genus. The species may be distinguished from *parvula*, its closest relative, by the small, dome-like mesal blade of the clasper, by the dentate dorsal processes of the aedeagus and the short ninth tergite.

Male.—Length 5 mm., this being one of the smallest *Tinodes* known. Wings uniformly fuscous, appendages a trifle darker in color, palpi brownish and hairy. Front tarsi without pre-apical spur, spurs fuscous and hairy. *Genitalia* as in fig. 5. Ninth tergum produced dorso-caudad as a short triangular lobe, from dorsal aspect apex acute, apical and lateral margin fringed with a membranous sheath. Ninth sternum sub-triangular, produced ventro-caudad, from ventral aspect distal margin wide and straight. Cerci elongate, fusiform, extending caudad as far as any other part of genitalia. Basal segment of clasper somewhat quadrate with ventral margin considerably wider than dorsal, connected to ninth sternum by a membranous lobe; apical segment slender, irregular, dorso-basal portion rounded, apical portion narrowed and directed ventro-caudad, from ventral aspect apices not convergent, mesal corner of apex bearing a short black spine. Mesal blade of claspers with dorsal margin dome-shaped and produced dorsally into an acute apex, distal portion narrow, apex obtuse and curved ventrad, from ventral aspect lobes are closely appressed and apex thus appears bilobed. Sheaths of aedeagus—probably all that remains of the tenth tergite—long, slender, apex obtuse, armed with prominent and abundant setae, especially a wide spine-like seta at apex; aedeagus with apex narrowed, a pair of teeth-like processes arise sub-apically and near their base a short spinous process.

Holotype male. CASCADE HEAD EXPERIMENTAL FOREST, NEAR OTIS, OREGON, July 27, 1951, K. M. Fender.



EXPLANATION OF FIGURES

Fig. 1. *Rhyacophila wallowa,* male genitalia; 1A, lateral aspect. Fig. 2. *Rhyacophila chandleri,* male genitalia; 2A, lateral aspect; 2B tenth tergite, dorsal aspect; 2C, aedeagus, lateral aspect. Fig. 3. *Rhyacophila pichaca,* male genitalia; 3A, lateral aspect; 3B, tenth tergite, dorsal aspect; 3C, aedeagus. Fig. 4. *Rhyacophila lineata,* male genitalia; 4A, lateral aspect. Fig. 5. *Tinodes cascadia,* male genitalia; 5A, lateral aspect. Fig. 6. *Wormaldia pachita,* male genitalia; 6A, lateral aspect; 6B, tenth tergite, dorsal aspect; 6C, apex, apical segment of clasper. Fig. 7. *Polycentropus clinei,* male genitalia; 7A, lateral aspect, 7B, tenth tergite, dorsal aspect.

KEY TO NEARCTIC TINODES

Males

1. Apical segment of clasper deeply emarginate, resulting in a wide basal portion, and a narrow oblique apical portion.....*siskiyou* Denning
   Apical segment slender throughout, much narrower than basal segment 2
2. Apical segment of clasper pointed and oblique at apex, dorsal spur near apex .....*signodana* Ross
   Apical segment slender and rounded or truncate at apex..... 3
3. Apical segment slender and truncate at apex..... 4
   Apical segment slender and rounded at apex..... 5
4. Mesal blade of basal segment of clasper broadly curved dorso-caudad, apex aedeagus bifid.....*parvula* Denning
   Mesal blade of basal segment of clasper short, dome-like with an acute dorsal apex, apex aedeagus not bifid.....*cascadia* Denning
5. Apical segment of clasper elongate and sinuous, as long or longer than basal segment .....*belisa* Denning
   Apical segment of clasper not any longer than basal segment, somewhat sausage-shaped 6
6. Mesal blade of basal segment of clasper short, widely curved caudad .....*provo* Ross
   Mesal blade of basal segment of clasper long and narrow, curved ventro-caudad .....*consueta* McLean

Wormaldia pachita Denning, new species

Wormaldia pachita is a member of the Moesta group and represents the thirteenth Nearctic species in the genus. Along with *anilla* (Ross), *cruzensis* (Ling) and *hamata* Denning it belongs to the subgroup of the genus in which the seventh and eighth sternites are without mesal projections. However, the general appearance of the genitalia bear closest resemblance to *strota* (Ross) and *sisko* (Ross) in possessing a long apical segment of the clasper. The spatulate apical segment of *pachita* will easily separate it from other described species.

Male.—General color flavescent. Seventh sternite with no mesal process. Eighth segment normal, no sternal mesal process. *Genitalia* as in fig. 6. Ninth segment narrow throughout, dorsum indented to receive tenth tergum and cerci; sternum produced caudad considerably beyond remainder. Tenth tergite carinate, seen from lateral aspect, fig. 6, structure gradually narrowed to a sub-acute apex, projecting caudad slightly beyond ninth sternite; from dorsal aspect, fig. 6B, structure elongate, triangular, gradually narrowed to a sub-acute apex, projecting caudad slightly beyond ninth sternite; setation sparse. Cerci slender, digitate, slightly shorter than tenth tergite, acute apically; setae sparse. Clasper with basal segment considerably shorter and stockier than apical segment; apical segment elongate, constricted along middle, spatulate and apical margin circular. Mesal pad of mesal

surface of apical segment of clasper, fig. 6C, consists of a narrow band of short dense reddish brown spicules. The genitalia and specimen have been damaged.

Holotype male, GRASS VALLEY, NEVADA COUNTY, CALIFORNIA, ELEVATION 2350 FEET, May 5, 1946, H. P. Chandler. Holotype deposited in the collection of the Academy of Sciences, San Francisco, California.

KEY TO NEARCTIC WORMALDIA[1]

Males

1. Tenth tergite divided into a pair of heavily sclerotized hooks.....*major*
   Tenth tergite not heavily sclerotized and at most only slightly hooked 2
2. Tenth tergite with a basal hump and clavate distally.....*arizonensis*
   Tenth tergite not clavate distally..... 3
3. Seventh sternite having a long, narrow apico-mesal process..... 4
   Seventh sternite having a triangular process broad at base, or none.. 5
4. Eighth sternite with a long apico-mesal process.....*moesta*
   Eighth sternite with only a short process or none.....*gabriella*
5. Eighth tergum normal 6
   Eighth tergum with long dorsal elongation.....*hamata*
6. Seventh sternite with a triangular process..... 7
   Seventh sternite with no mesal process..... 10
7. Clasper elongate, basal segment considerably longer than tenth tergite 8
   Clasper short and stocky, basal segment equal to or but slightly longer than tenth tergite 9
8. Apical segment shorter than basal segment.....*sisko*
   Apical segment equal to basal segment, dorsal margin markedly convex .....*thyria*
9. Apical segment of clasper much longer than basal segment.....*shawnee*
   Apical segment of clasper slightly shorter than basal segment....*occidea*
10. Basal segment elongate, longer than tenth tergite..... 11
    Basal segment short, not longer than tenth tergite..... 12
11. Tenth tergite truncate, hooked ventrad at apex, mesal pad on apex of apical segment of clasper with short black setae.....*strota*
    Tenth tergite with apex acute, mesal pad on apex of apical segment of clasper with short reddish brown setae.....*pachita*
12. Apical segment of clasper markedly constricted beyond middle.....*anilla*
    Apical segment of clasper parallel-sided.....*cruzensis*

POLYCENTROPUS CLINEI Milne

The genus Polycentropus is represented in the United States and Canada by 29 recognizable species. All but one of these, *Polycentropus clinei*, is readily identifiable from available keys and illustrations.

[1] Adapted from Ross, 1949, Proc. Ent. Soc. Wash. 51(4) :158.

The male genitalia of this species, fig. 7, is apparently quite variable. The mesal lobe of the ninth sternum may be as short as in fig. 7, or long, projecting caudad to distal margin of the claspers; dorso-mesal lobe of clasper may be short as in figure or long and slender. However variable certain details of the male genitalia may be *clinei* is easily recognized by the tenth tergite, especially when viewed from dorsal aspect, fig. 7B. The bilobed lateral lobes, and the widely emarginate mesal lobe will distinguish *clinei* from other species.

Previously known only from the New England states *clinei* is here recorded from Halifax County, Nova Scotia, June 26, 1951, C. P. Alexander.

POLYCENTROPUS ARIZONENSIS Banks

Previously recorded only from Arizona. It is here recorded from New Mexico: Whitewater Canyon, near Glendwood, Aug. 20, 1953, H. B. Leech.

POLYCENTROPUS SMITHI Denning

This species was originally described from Mt. Washington, New Hampshire. The collection of *smithi* in the Yukon Territory would suggest a holarctic distribution. It is here recorded from: Yukon Territory, along Alaska Highway, Mile Post 1012, July 4, 1952, C. P. Alexander.

DRAPETIS TRICHURA MELANDER IN CALIFORNIA

(Diptera: Empididae)

A single male specimen of *Drapetis trichura* Melander 1918 was swept from desert plant growth at Palm Springs, Riverside County, California, on December 25, 1952 (P.H.A.). The determination was kindly made by Dr. A. L. Melander. Dr. Melander informed the writer that this is the second specimen of *trichura* that he has seen. This species was described from a male collected at Austin, Texas.—P. H. ARNAUD, *Stanford University*.

THE FIRST CALIFORNIA RECORD OF BOREUS CALIFORNICUS FUSCUS CARPENTER

(Mecoptera: Boreidae)

John D. Lattin

Department of Entomology, Oregon State College, Corvallis

The genus *Boreus* is restricted to North America and Europe. Adults generally appear during the winter months when mating takes place on the surface of the snow. Eleven species are known from northern North America, with the majority of the species being restricted to the northwestern part of United States, Canada and Alaska. The females are almost completely wingless, the wings merely represented by small pads. The males have the wings reduced and slender somewhat resembling the elytra of the beetle family Rhipiphoridae.

A male of *Boreus californicus fuscus* Carpenter was collected on the surface of the snow on December 4, 1954 at Sagehen Creek, near Hobart Mills, Sierra County, California by Elbert Brock. The elevation of the locality is about 6,500 feet. The specimen has been deposited in the collection of the California Insect Survey, University of California, Berkeley. The only other specimen of this genus in the survey collection is a female of *Boreus unicolor* Hine, collected at Kawick Mountains, Silverbow, 7000 feet, Nye County, Nevada on January 23, 1921 by L. S. Graves.

The Sagehen specimen of *Boreus californicus fuscus* is 3 mm. long, the body bronze blue-black with the wings and proboscis yellow-brown and the legs dark brown. It differs from the original description by having the length of the rostrum 2 times longer than the width of the eye but agrees in all other respects (the length of the rostrum in the type is one and one-half times the width of the eye). The typical subspecies was described by Packard from material collected at Fort Bidwell, Modoc County (not Siskiyou County as Carpenter (1935, 1936) states), California. Carpenter (1935:117) reports additional material of *Boreus californicus californicus* from Goose Lake, Modoc County (not Siskiyou County), California. *Boreus californicus fuscus* was described by Carpenter (1935:117) from British Columbia, Monana and Alberta and differs from the typical subspecies by having its legs and wings brown, the eyes gray-brown and in being smaller (3.5–4 mm. in *B. c. californicus* Packard; 3 mm. in *B. c. fuscus*

Carpenter). Collectors visiting the mountains during the winter should look for this interesting species on the snow.

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ASSOCIATION OF HOLCOPASITES WITH PSEUDOPANURGUS IN MEXICO

(Hymenoptera: Anthophoridae, Andrenidae)[1]

E. G. LINSLEY, J. W. MACSWAIN AND RAY F. SMITH
University of California, Berkeley

During the second week of August, 1954, in an area nine miles southwest of Fresnillo, Zacatecas, Mexico ,three species of *Holcopasites*, *H. arizonicus* (Linsley), *H. robertsoni* (Crawford), and *H. calliopsidis* (Linsley) were found associated with the nests of three species of *Pseudopanurgus*. The latter (which we have not been able to identify) occupied slightly separated nesting sites and it appeared the parasitic bees were species-host-specific in this area. In the general area numerous anthophorid bees were nesting *(Diadasia, Ptilothrix. Melissodes, Anthophora, Xenoglossodes, Hemisia)*, some halictines *(Halictus, Agapostemon, Lasioglossum)* and a few other genera but no other panurgids. *Holcopasites calliopsidis* has been previously reported from nesting sites of *Calliopsis andreniformis* Smith (Ainslie, 1937; Linsley, 1943).

Holcopasites arizonicus was previously known from Arizona (Yuma, Tuscon, Hereford) and Baja California (San Pedro, 18 miles south of La Paz) (Linsley, 1942, 1943), *H. robertsoni* from Nebraska, North Dakota, Alberta and Colorado (Linsley, 1943) and *H. calliopsidis* from Montana, Iowa, Kansas and Colorado (Linsley, 1943, 1944).

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LINSLEY, E. G.
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1944. New species of Neopasites with notes concerning others. Jour. New York Ent. Soc., 52:277–280.

[1] One of a series of studies made possible by a grant-in-aid from the Associates in Tropical Biogeography, University of California.

TWO NEW SPECIES OF MIPSELTYRUS FROM CALIFORNIA

(Coleoptera: Pselaphidae)

Robert O. Schuster
University of California, Berkeley

This genus was previously known from one species, *Mipseltyrus nicolayi*, which was described by Dr. Park in 1953.[1] While *M. nicolayi* is known from North Carolina and Tennessee, the author feels that the disjunct distribution produced by the addition of California species is an artifact that will be removed by future collecting.

Mipseltyrus parki Schuster, new species

(Figs. 1, 2, 4, 5)

Male.—Head 0.38 mm. long × 0.26 mm. wide; pronotum 0.39 × 0.33; elytra 0.46 × 0.67; total length 1.51 mm.; width across first visible tergite 0.75 mm.

Rufotestaceous; body slightly punctate, antennae and tibia granulate, head anterior to eyes polished; pubescence decumbent, directed medially on head and pronotum, less so on abdomen, longitudinally on elytra, distally on legs and antennae. Head with vestigial eyes of two or three facets, eyes visible from above; temporae nearly one-half head length, slightly curved; two, deep, nude, vertexal foveae and median frontal fovea at apices of equilateral triangle (vertexal foveae are tentorial, median frontal fovea ends a short distance below surface); frons vertical, forming thin, semitransparent lamina between antennal acetabula; clypeus short, flat; labrum short, transverse; ventral surface of head flat; gular fovea and posterior lateral angles bearing dense, branched pubescence. Maxillary palpi long, four segmented, proportions as illustrated (Fig. 1). Antennae eleven segmented, three of which form the club; segmental proportions of club as illustrated (Fig. 2). Pronotum widest before middle; three, small, nude, antebasal foveae removed from basal margin by approximately one-fourth pronotal length. Elytra with large, obliquely rounded humeral angles; each elytron with two, pubescent, antebasal foveae; median fovea originating at base of entire sutural stria, lateral fovea free; elytral flank lacking subhumeral fovea and epiplural sulcus; apical margins fringed with long, dense pubescence. Metawings not present. Abdomen about one-third total length, deflexed; first three visible tergites margined, visible from above; median tergite ratios 3.3/2.2/1.3/1.5/1.0; base of first transversely impressed, impression with dense, branched pubescence; median sternite ratios 7/17/7/5/3/5/1; impression at base of second similar to the dorsal; fifth and sixth sternites punctate; sixth medially emarginate apically; seventh a small penal plate. Prosternum short with branched pubescence

[1] New or little known pselaphid beetles of the United States, with observations on taxonomy and evolution of the family Pselaphidae. Chicago Acad. Sci., Bull., 9(14): p. 249-283, pl. 1-5.

before coxal cavities; mesosternum with large median fovea and two similar impressions with branched pubescence along anterior margins; a nearly nude fovea between, and two pubescent foveae lateral to mesocoxal cavities. Tarsal claws large, subequal; trochanters without sexual modification. Genitalia as illustrated (Figs. 4, 5).

Female.—As in the male with the following exceptions; tenth antennal segment hexagonal, not asymmetrically produced; only six sternites.

The author dedicates this species to Dr. Orlando Park for his kind assistance with this group of beetles.

Holotype male, taken from litter east of BRICEBURG, MARIPOSA COUNTY, CALIFORNIA by the author on March 12, 1955. Additional specimens in the type series were taken by the author at the same locality on the following dates: ♂, II-5-55; 2♂♂, 5♀♀ III-12-55. The holotype and one paratype are deposited in the California Academy of Sciences, two paratypes in the collection of Orlando Park and the remaining specimens in the California Insect Survey.

Mipseltyrus mirus Schuster, new species

(Fig. 3)

Male.—Head 0.39 mm. long × 0.26 mm. wide; pronotum 0.39 × 0.36; elytra 0.49 × 0.77; total length 1.75 mm.; width across first visible tergite 0.86 mm.

Essentially as described for *Mipseltryrus parki* except for the following differences. Head anterior to eyes reticulate, legs entirely granulate; eyes reduced to single facet; tenth antennal segmen hexagonal, not produced at inner apical angle; fifth sternite subglabrous; sixth with subglabrous concavity at median one-third; genitalia differing in shape and proportions as illustrated (Fig. 3).

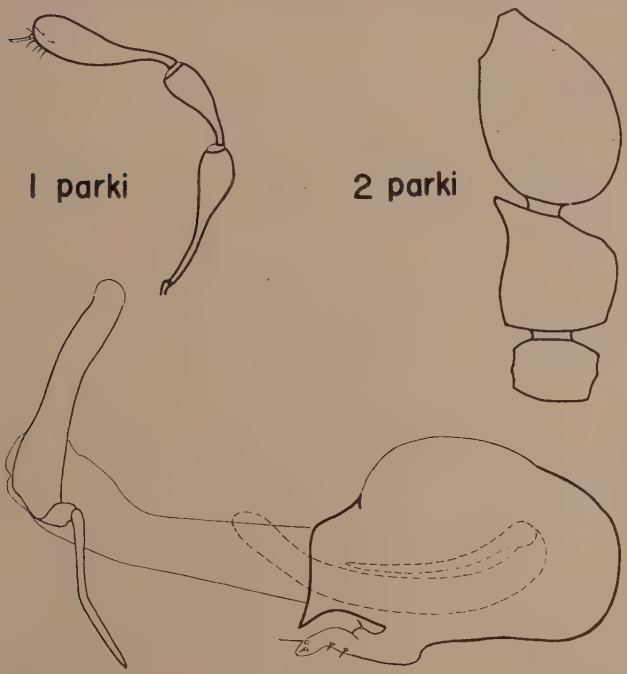
Female.—As in the male but differing in having only six sternites; sixth sternite evenly rounded.

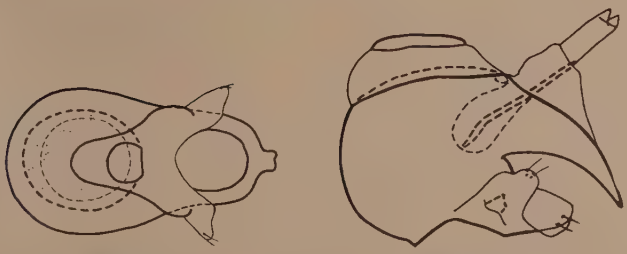
Holotype male, taken from litter, mainly *Pseudotsuga menziesii*, at RIVERTON, ELDORADO COUNTY, CALIFORNIA on May 8, 1954 by B. J. Adelson and R. O. Schuster. Additional specimens in the type series were taken at the same locality on the following dates: 3♂♂, 2♀♀ IV-30-54 R. O. Schuster; 6♂♂, 4♀♀ V-8-54 B. J.

EXPLANATION OF FIGURES

Fig. 1. *Mipseltyrus parki* new species, maxillary palpus of male. Fig. 2. *Mipseltyrus parki* new species, antennal club of male. Fig. 3. *Mipseltyrus mirus* new species, male genitalia, lateral aspect with dotted line indicating position of internal sack not extended, 0.30 mm. long. Fig. 4. *Mipseltyrus parki* new species, male genitalia, ventral aspect. Fig. 5. *Mipseltyrus parki* new species, male genitalia, lateral aspect, 0.28 mm. long.

Adelson, R. O. Schuster; 2♂♂, 2♀♀ IX-8-54 R. O. Schuster. The holotype and two paratypes are deposited in the California Academy of Sciences, four paratypes in the collection of Orlando Park and the remaining paratypes in the California Insect Survey.





Both sexes of *M. mirus* have granulate femora allowing easy discrimination from *M. parki* in which the femora are only slightly punctate. The Californian species differ from *M. nicolayi* in the males lacking armed pro and mesotrochanters.

Book Review

RADIOISOTOPES IN BIOLOGY AND AGRICULTURE. By C. L. Comar. McGraw-Hill Book Co., N.Y. XIII plus 481 pp. 1955. Price $9.00.

There are two groups of investigators who turn to the use of radioisotopes in biological studies. The first group has a knowledge of the basic chemistry and physics of radioactivity and seeks to apply this to a specific problem. The second, and far larger group, has heard of the power and efficiency of this new technique and feels certain that it will solve most of its problems. "Radioisotopes in Biology and Agriculture" has been written with both groups in mind. Even the investigator experienced in this field will find new and intriguing applications. But it is primarily for the novice that Comar has written the book. The first chapter is a survey with pertinent examples of the general ways in which radioisotopes are used with an emphasis on quantitative interpretation. Suggestive examples are chosen from such diverse fields as photosynthesis, insect migration and human physiology. The second chapter deals with the principal difficulties inherent in the use of radioisotopes and shows how they may be avoided or allowed for.

The third chapter deals with the subject of health physics. In these days of conflicting and often overly optimistic or pessimistic views on the hazards of radioactivity it is refreshing to read a sane and well documented account of the problems and their solutions. The reader will learn that careful planning and adequate precautions will make the use of radioisotopes no more dangerous than many commonly accepted laboratory procedures. At the same time, the need for care and thought is adequately emphasized. The potential user of radioisotopes should contact the health branch of his institution and local authorities for special procedures.

Following this general introduction to principles, the next three chapters deal with experimental methods. Enough information is often given to enable one to design his experiment and select the appropriate method. An excellent bibliography will aid in supplying the details. Each radioactive isotope is treated in sufficient detail so that an intelligent selection can be made.

The remainder of the book is devoted to a short but pertinent discussion of autoradiography, paper chomatography, ion exchange and radioactivation analysis and their use in the isolation and analysis of isotope containing substances.

The bare recital of the topics considered in this book cannot do justice to Comar's careful choice of examples and the wealth of important detail he manages to include without burden to the reader. Anyone planning new applications of radioistotopes to biological problems or seeking to interpret published results will be helped by this book.—R. Craig.

DESCRIPTION OF A NEW SPECIES OF DIADOCIDIA FROM CALIFORNIA

(Diptera: Mycetophilidae)

Paul H. Arnaud[1] and Charles P. Hoyt[2]

The small subfamily Diadocidiinae of the family Mycetophilidae was previously known in North America by only two recent species, *Diadocidia ferruginosa* (Meigen), 1830 and *Diadocidia borealis Coquillett*, 1900 as well as a fossil form, *Diadocidia terricola* Scudder, 1878. The discovery of a new species is therefore of interest, and it is here described so that its name will be available for discussion in a forthcoming morphological paper.

The type locality of the new species is in a partially wooded field on the Stanford University campus about 100 yards northeast of the Stanford Mausoleum. This area has been partially replanted with Eucalyptus trees *(Eucalyptus globulus)*. Some of the trees have been cut down, and the resultant rotting stumps provide an attractive breeding place. Adults have been collected in large numbers around and within the hollows of these stumps, while the larvae have been found in moderate numbers in the decaying wood.

The authors are indebted to Mr. Paul Freeman and the authorities of the British Museum (Natural History) for the gift of a male specimen of *Diadocidia ferruginosa* and to Dr. Alan Stone and the authorities of the United States National Museum for the loan of specimens of *Diadocidia borealis*.

Diadocidia stanfordensis Arnaud and Hoyt, new species

Male.—Head mainly gray-black; palpi yellowish-brown; antennae with first two segments yellow-brown; remaining 14 segments uniformly gray with short yellow hairs. Ratio of antennal segments 8:9:26:16:15:15:15:15:15:14:14:14:13:12:12:13. *Thorax* grayish-yellow, with yellowish colored hairs; dorsally with a median and a pair of lateral, lightly colored vittae which converge posteriorly; scutellum with yellowish colored hairs. Coxae to femora yellow-brown; tibiae, tarsi and spurs dark grey.

Ratio of length of leg segments

	C	Tr	F	Ti	T1	T2	T3	T4	T5	Claws
Fore leg	30	7	46	65	43	15	12	8	7	2
Mid leg	32	7	52	75	42	13	10	6	5	2
Hind leg	25	7	64	101	41	13	10	6	6	2

Wing venation as illustrated in Figure 1,D. Veins and membrane conspicuously hairy. Halteres yellowish-brown. *Abdomen* unicolorous, gray, with light colored hair. Segments one and eight shortened; segment one a

[1] Natural History Museum, Stanford University, California.

[2] South Pacific Commission, Boitè Postal No. 9, Noumea, New Caledonia.

little longer than half length of second; segment eight less than half length of seventh. Male terminalia colored as abdomen. The characteristic terminalia are illustrated in Figures 1, A-C. Body length, 3.5 mm.; wing length, 3 mm.

Female.—Similar to male with exception of sexual armature. Fore tarsi not broadened. Terminal abdominal appendages as illustrated in Figures 1, E. Body length, 4 mm.; wing length, 4 mm.

Diadocidia stanfordensis, which is related to *ferruginosa,* may be readily separated by the characteristic divided dististyle in conjunction with the wing venation. The spermathecal structure in the female may also prove to be characteristic only of this species.

Holotype male, STANFORD UNIVERSITY, SANTA CLARA COUNTY, CALIFORNIA, April 22, 1952, (C. P. Hoyt), on slide. Allotype, female, same locality as holotype, collected January 19, 1952, (C. P. Hoyt), on slide. Holotype and allotype deposited in the collection of the Department of Entomology, California Academy of Sciences, San Francisco. Paratopotypes: 342 specimens, 327 males, 15 females, same locality as holotype, on the following dates and method of preservation: Slides: male, 22.IV.52 (Hoyt); 2 males, 19.I.52 (Hoyt). Alcohol: 19 males, 23.IV.52 (Arnaud); 45 males, 3 females, 26.I.53 (Arnaud); 152 males, 7 females; 5.II.53 (Arnaud); 68 males, 5 females, 18.II.53 (Arnaud). Pinned: 5 males, 26.II.52 (Arnaud); 20 males, 11.III.54 (Arnaud); 15 males, 25.III.54 (Arnaud). Paratopotype slides have been deposited in the collections of the United States National Museum and the British Museum (Natural History).

Our method of collecting population samples of the new species has resulted in an interesting ratio of approximately 20 males to 1 female.

The larva of *stanfordensis* is enclosed in a slime tube which it secretes as it moves along over the surface of the wood. The track left by this collapsed tube resembles that of a small slug or snail. The larva of *ferruginosa* has been figured and discussed by Madwar (1937:36–39) and differs from *stanfordensis* in the number of inner mandibular teeth, *ferruginosa* having two, *stanfordensis* one.

CHECKLIST OF RECENT DIADOCIDIA:

1. *borealis* Coquillett, 1900.....North America
2. *ferruginosa* Meigen, 1830.....Europe, North America
3. *ferruginosa* var. *thoracica* Okada, 1936.....Japan
4. *nigripalpis* Edwards, 1940.....Chile, Brazil

5. *spinosula* Tollet, 1948.....Belgium
6. *stanfordensis* Arnaud and Hoyt, 1956.....California
7. *valida* Mik, 1874.....Central Europe
8. species (Freeman, 1951).....Tasmania

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1951. Diptera of Patagonia and South Chile. Based mainly on material in the British Museum (Natural History). Part III—Myceto-

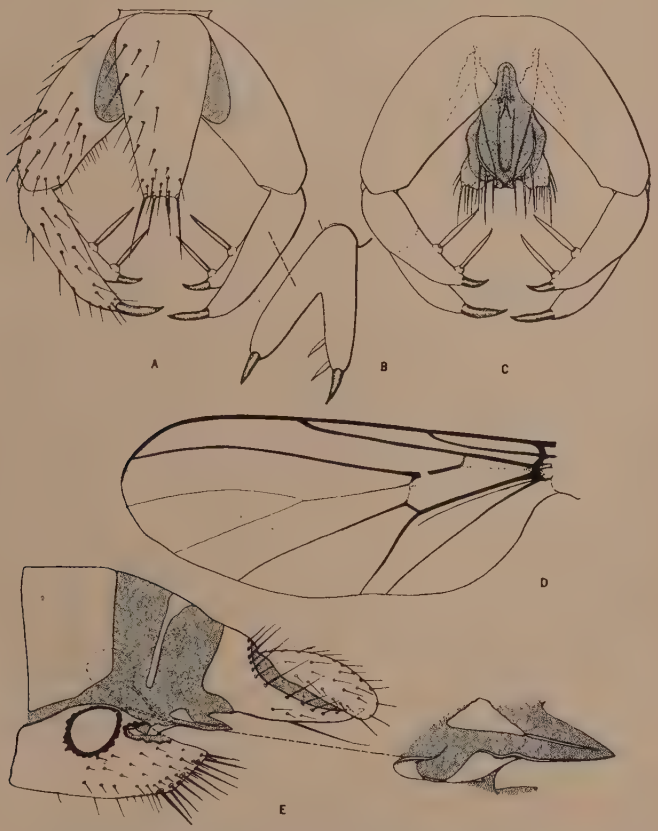

Fig. 1. *Diadocidia stanfordensis*: A. Dorsal aspect of male terminalia; B. Apical aspect of dististyle; C. Ventral aspect of male terminalia; D. Wing of male; E. Lateral aspect of terminal abdominal segments of female.

philidae. i–vii plus 138 pp., plates I–XLIX (Diadocidiinae, pp. 10–12).

MADWAR, S.

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DESCRIPTION OF TWO NEW SPECIES OF DIADASIA FROM NORTH AMERICA[1]

(Hymenoptera: Apoidea)

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Since the genus *Diadasia* extends far into South America and the bee fauna of Mexico is only beginning to be studied extensively, discovery of a new species in Mexico was not unlooked for, but that a large and beautiful new species should turn up in New Mexico seems strange and noteworthy.

Diadasia mexicana Timberlake, new species

This new species from Zacatecas, Mexico, is a close ally of *D. diminuta* (Cresson) and rather difficult to distingush therefrom in the female sex. The male is easily recognized by the dense, ochreous hair on the apical ventral segment and by the longer, shaggier hair on the tergum of the abdomen. The genitalia of the two species are very distinctive.

Female.—Black, the tegulae at apex and base of the claws with a reddish tinge, the tibial spurs testaceous. Pubescence ochreous, becoming paler or whitish on under side of head and thorax and inner side of legs. Apical fringe on tergite 5, except at sides, brown or blackish; hair of tergite 6, of the venter almost entirely, and of inner side of middle and hind basitarsi, black or blackish. Upper part of frons and each side of the vertex beyond ocelli, as well as a large area on middle of disk of mesoscutum, almost perfectly nude. Hair of tergum of abdomen long, fine, and depressed except on the basal part of the first segment, becoming much denser at apex of tergites 1 to 4 to form distinct narrow bands. Puncturation rather coarse and sparse on clypeus, virtually obsolete on frons and vertex, and fine and moderately close on mesoscutum, except that it is obsolescent on middle of disk. The female is distinguishable from *diminuta* by the finer hair of tergum of abdomen: the broader apical bands: the more finely and more sparsely punctured mesocutum, with a large, nearly impunctate median area; and by the hair on the nearly nude area of frons, which is finer, shorter, and much less evident than in *diminuta*. Length, about 8–9 mm.; anterior wing, 6:9–8 mm.

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Male.—Similar to female, but pubescence much denser on face, thorax, and abdomen, as is usual in the genus. Upper part of frons and sides of vertex nude, but mesoscutum nearly uniformly punctate and covered with long, erect hair. Hair of tergum of abdomen rather dense, long, and erect, not forming narrow apical bands as in *diminuta*. Hair on the normally exposed part of the sixth ventral segment long and dense. (In *diminuta* this segment is comparatively nude.) Most structural characters as in *diminuta*, but aedeagus distinctive; parameral lobes of caulis long, the basal third slender, then moderately dilated to the apical fifth, which is abruptly narrowed to the acute apex; process overlying inner margin of base of parameral lobes very small and conical. (In *diminuta* the latter process is large and broad and the parameral lobes are acuminate nearly from the base, with the outer margin strongly arcuate.) In both species the caulis is destitute of a dorsal spine or spur directed inward over the base of the parameral lobe and process. Length, 7–8.5 mm.; anterior wing, 7–7.6 mm.

Described from 53 females, 3 males (holotype female, allotype, and paratypes), 9 MILES SOUTHEAST OF FRESNILLO, ZACATECAS, MEXICO, August 7–14, 1954 (E. G. Linsley, J. W. MacSwain, and R. F. Smith).

Types and 6 paratype females in collection of the Citrus Experiment Station, Riverside; remainder of paratypes in collection of the University of California, Berkeley.

Diadasia vestita Timberlake, new species

The male of *vestita* runs in my table of *Diadasia* (Bull. Brooklyn Ent. Soc. 36:3–6) to *D. enavata* (Cresson) and differs in having the sixth ventrite truncate in the middle of the apex and its hair divided into three patches, one across the truncate part of apex and one on each side toward the base. The aedeagus also is very different from that of *enavata*.

In Cockerell's key (1905, Amer. Nat. 39:741–745) this species runs again to *enavata*. I do not believe that it can be *D. megamorpha* Cockerell, a species unknown to me, which is separated in Cockerell's key by its large size (length 16 mm.) and which has the mesoscutum nearly nude.

Male.—Black, the small joints of tarsi reddish, the spurs rufo-testaceous. Pubescence dense, erect, nearly concealing surface of all parts, except that it is thin on vertex, with upper part of frons, the sides of vertex, and basal area of propodeum, nude. Hair of head and thorax pale ochreous, more whitish on cheeks, under side of thorax, and on legs, except that on outer side of hind tibiae and tarsi it becomes brighter ochreous. Hair on inner side of middle and hind basitarsi dark reddish brown. Hair of tergum of abdomen shorter than that of thorax (excepting the long hair on base of tergite 1), much less plumose, and brownish yellow in color, with a

narrow, paler fringe at apex of tergites 2 to 6. Head slightly broader than long, the flagellum of antenna thicker than in *enavata*, with the joints less elongate. Hind legs slightly more incrassate and hind basitarsi longer and more curved than in *enavata*. Tergite 7 ending in two blunt processes which are mainly covered by the pubescence. Clypeus, lower part of the frons, and the mesonotum with fine and rather close punctures. Seventh ventrite twice bilobate, the two lobes on each side separated from each other by a broad, oval emargination, and the outer lobe longer and broader than the inner. Caulis of aedeagus broader than long and with a long sharp spur directed inwardly on each side above; parameral lobes very long, slender, and with the apical fifth tapering to a sharp point; process on inner margin at base of parameral lobes rather long and broad, longer even than the spur of the caulis. Length, about 11 mm.; anterior wing, 11 mm.

One male (holotype), Rio Puerco, Bernalillo County, New Mexico, Sept. 8, 1951 (M. F. McClay), in collection of the Citrus Experiment Station, Riverside.

Book Review

ISLAND BIBLIOGRAPHIES—MICRONESIAN BOTANY / LAND ENVIRONMENT AND ECOLOGY OF CORAL ATOLLS / VEGETATION OF TROPICAL PACIFIC ISLANDS. By Marie-Hélène Sachet and F. Raymond Fosberg. Pacific Science Board; National Academy of Sciences —National Research Council, Washington 25, D. C., Publ. 335, i–v, 1–577, 1955. Photo offset. $6.00.

This extensive bilography will be extremely useful, and necessary to anyone interested in the natural history of Pacific islands, and in the atolls of the world. Hundreds of entomological articles are listed, including possibly all references to insects on atolls. There is considerable annotation, and extensive indexing by subjects, including insects. As indicated by the three subtitles, the work is divided into three sections. Each section is separately indexed. The first two sections are fully indexed both geographically and by subjects, and the vegetation section is indexed geographically. There is also an extensive alphabetical explanatory list of serial abbreviations, giving place of publication and library call numbers for the Library of Congress, or other library if lacking or incomplete in the Library of Congress. There are also addenda bringing each section up to the minute.

This work is obviously most thorough and useful. Some space might have been saved and possible time saved in using the work if all were arranged in a single bibliography with complete cross-indexing, even though the first section concerns only Micronesia, the second the whole world, and the third the Pacific area. With the addenda there are eleven sections, not counting several separate introductory discussions.

—J. Linsley Gressitt.

THE FALSE SPIDER MITE, BREVIPALPUS LEWISI McGREGOR — A POTENTIAL PEST OF ENGLISH WALNUT

(Acarina: Phytoptipalpidae)

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According to Pritchard and Baker (1951) the false spider mite, *Brevipalpus lewisi* McGregor is only known from California. They reported it from a number of localities in the San Joaquin and Sacramento Valleys as well as from Riverside. Lewis (1944) reported it as causing damage to lemons at Porterville, and in the same area Ebeling and Pence (1949) associated the mite with serious injury to pomegranate.

On September 15, 1953 a small localized infestation of this mite[1] was encountered on the southeast side of a single walnut tree in a 160-acre orchard at Linden, California where walnut insect investigations were being conducted. No expansion in the infestation was observed for the remainder of the season, and the mite was not encountered in 1954.

On September 21, 1955 a destructive infestation of *Brevipalpus lewisi* McGregor was found to exist over a portion of the experimental orchard. A survey was conducted and it appeared that the mite had apparently dispersed outward in a broad arc from the point where it was noted in 1953. At the time the infestation was detected, some defoliation had already occurred. This was noticeable on the south-east exposure of the trees and was most pronounced about the skirt of the trees. The degree of infestation was not uniform, and in the most severe cases it was approaching the lower limit of economic damage.

The presence of the false spider mite might in all probability have been detected sooner had it not been for the fact that throughout the orchard there was a light, but not destructive, infestation of the Pacific spider mite *Tetranychus pacificus* McGregor and the European red mite, *Metatetranychus ulmi* (Koch.).

Brevipalpus lewisi McGregor is a very small flattened species that can just be seen with the naked eye. On walnut it is able to develop in enormous numbers and heavily infested leaves practi-

[1] Specimens determined by A. Earl Pritchard, Department of Entomology and Parasitology, University of California, Berkeley, California.

cally swarm with them. Where the population density is heavy the infested leaves become somewhat coppery in appearance. The damage done is similar to that caused by the Pacific spider mite but the coppery color of the leaves serves to differentiate the work of the false spider mite from that of the Pacific spider mite. Further, with the former species, little or no webbing occurs. Where defoliation has been caused by the false spider mite, the dropped leaves are coated with white shed skins.

The false spider mite apparently spread without regard through plots treated with several aphicides which included the systemic insecticides Systox and OMPA. These materials appeared to exert no suppressing action upon the pest.

On September 21, when the false spider mite was observed the Pacific spider mite and the European red mite were being brought under complete control by natural enemies. Of the natural enemies *Stethorus* sp. appeared to be the most important. There were many other predators present including syrphid flies, lace wings, and predatory mites. None of these natural enemies seemed to exert any influence upon the false spider mite, and the latter gradually spread to all parts of the trees. They were still abundant in late October, long after harvest had been completed. Injury progressed until on some trees it reached the lower limit of economic damage.

This marks the first record of *Brevipalpus lewisi* McGregor on walnut and what the future may hold remains to be determined. However, the species has certainly demonstrated the possibility of it becoming a potential pest of walnut. The large number of overwintering adults in the infested orchard suggests that this will be the case.

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